26 January 1965

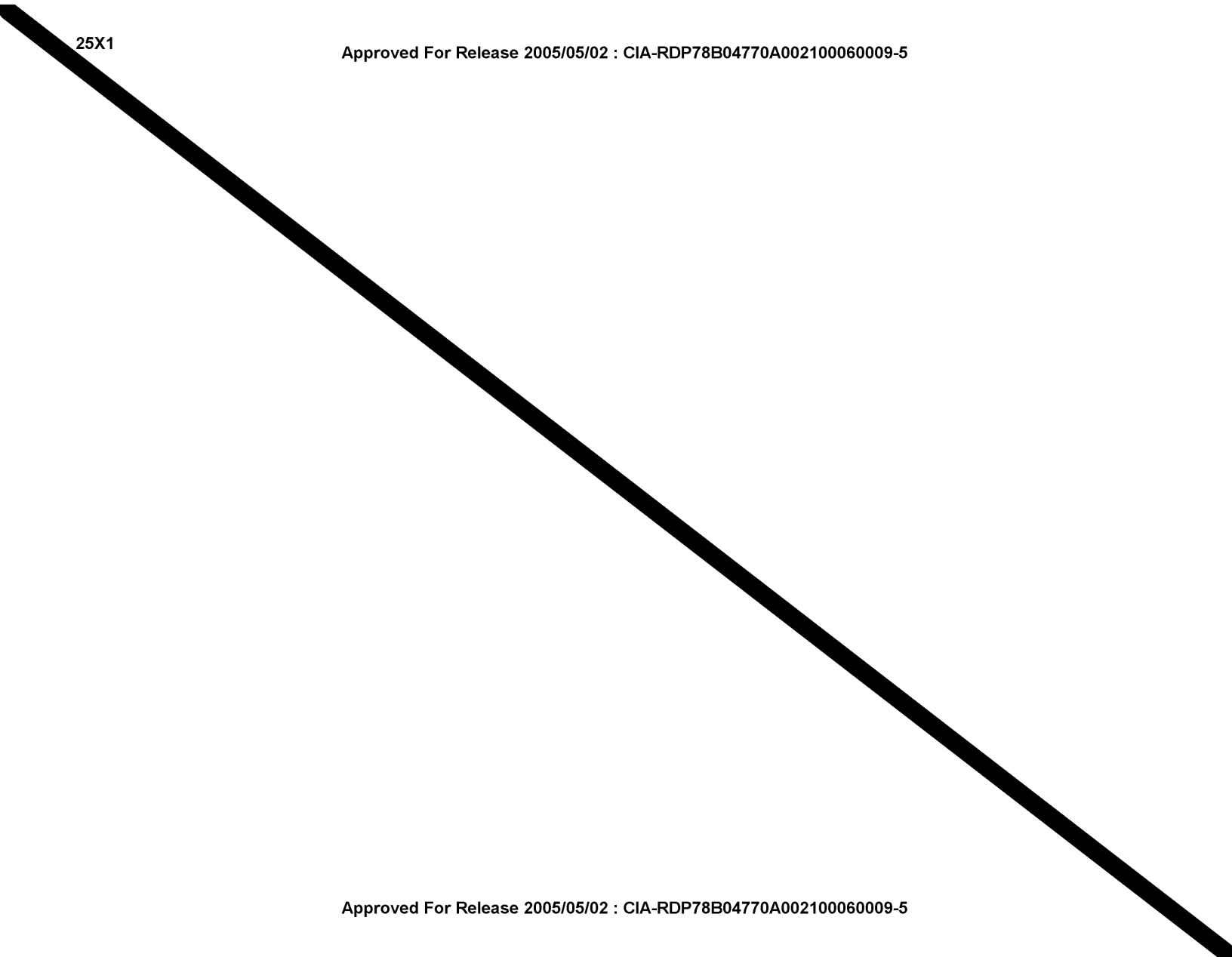
25X1

Contract [ ] - ACTIVE PAR TITLES AND PROPOSED CONDENSED TITLES

PAR	Title	Proposed Condensed Title*
202	Briefing Print Enlarger	Same as title.
203	[redacted]	Same as title.
206	Reversal Processing of High-Resolution Films Study	Reversal Processing Study
207	Definitive Study of Contact Printers	Contact Printer Study
211	Microdensitometer Study of Effects of Processing	Image Effects Study
212	Color Acquisition System Review Study	Color Acquisition Study
213	Color Reproduction Systems Review	Color Duplication Study
214	Roller Transport Reversal Processor (12-Inch)	Reversal Processor RT-12
215	Roller Transport Processor (24-Inch)	Processor RT-24
216	Exposure of Photographic Material with Lasers	Laser Photographic Exposure
217	Optimization of Lasers	Same as title.
222	Stereo Registration Systems	Stereo Registration System
223	Monochromatic Lens System	Monochromatic Lenses
224	3X - 15X Fluid Gate Enlarger	Fluid Gate Enlarger
225	Microdensitometer Training Program	Microdensitometer Training
226	Analysis of Photographic Images to Evaluate System Performance	Photographic Image Analysis

*Condensed titles are to contain a maximum of 30 characters including spaces.

Declass Review by NGA.



Approved For Release 2005/05/02 : CIA-RDP78B04770A002100060009-5

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FY-66 Quarterly Report, No. 1

PAR 203
31 Aug 65

SUBJECT: Rapid Access Printer

TASK/PROBLEM

1. To investigate commercially available continuous tone, dry or semi-dry, printing systems with the view of designing and fabricating a rapid access printer that can be used to reproduce photographic materials in photo interpretation areas under normal room lighting conditions.

DISCUSSION

2. Submission of final report, PAR 203, Rapid Access Printer, dated 1 July 65 constitutes project completion.

PLANNED ACTIVITY

3. None.

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MONTHLY REPORT

[redacted]

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PAR 203
30 Jul 65

SUBJECT: Rapid Access Printer

TASK/PROBLEM

1. To investigate commercially available continuous tone, dry or semi-dry, printing systems with the view of designing and fabricating a rapid access printer that can be used to reproduce photographic materials in photo interpretation areas under normal room lighting conditions.

DISCUSSION

2. The final report was completed and published.

PLANNED ACTIVITIES

3. Transmittal of the final report, PAR 203, Rapid Access Printer, to the customer in early August 65 will constitute project termination.

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GROUP 1
EXCLUDED FROM AUTOMATIC DOWNGRADNG AND DECLASSIFICATION

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AL-35-700042-/

PAR 203

FINAL REPORT

Rapid Access Printer

1 July 1965

Prepared by:

[redacted] 25X1

25X1

Approved by:

[redacted]

[redacted] 25X1

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GROUP 1
EXCLUDED FROM AUTOMATIC DOWNGRADNG AND DECLASSIFICATION

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PAR 203

1 July 65

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PAR 203
1 July 65

SUMMARY

The search for a photographic reproduction system that will yield high-quality positive images, with rapid and convenient handling in office-type surroundings, has readily eliminated all but two classes of products. One of these so far overshadows the other as to make it the only logical choice.

Modern diazo films yield direct positive images from positive originals, with exceedingly high resolution, good tonal characteristics, good exposure latitude, and simple processing. The convenience of the system is marred only by the need for a rather intense source of ultraviolet illumination available in the form of high-pressure mercury vapor lamps with appropriate electric power supplies.

PAR 203
1 July 65

SUBJECT: Rapid Access Printer

TASK/PROBLEM

1. To investigate commercially available continuous tone, dry or semi-dry, printing systems with the view of designing and fabricating a rapid access printer that can be used to reproduce photographic materials in photo interpretation areas under normal room lighting conditions.

INTRODUCTION

2. Inspection and evaluation of reconnaissance aerial photography often leads to the need for one or more additional copies of selected frames or portions of frames. Of major importance are the time and convenience requirements of an on-the-spot reproduction system, and the quality of the resultant photography. In addition, the reproduction should look as much as possible like the original photograph.

3. Several reproduction systems can readily be removed from consideration on the basis of inherent faults:

a. Conventional silver photography usually requires wet processing, and the materials are too sensitive to be handled under normal room illumination.

b. Rapid "office copying" systems use basically high-contrast non-continuous-tone materials.

c. Reproductions on paper base are not capable of the high quality required in most aerial photography.

d. Many systems yield only a negative from a positive, or vice-versa, thus requiring a second operation to achieve like-polarity reproductions.

4. Two types of currently-available materials remain from the reduced list of possible system choices:

a. Thermo-plastic vesicular resins.

b. Light-sensitive organic dyes of the diazo type.

Recent improvements in both classes of products have resulted in greatly enhanced photographic quality, with versions of each available which will yield direct positive prints from positive originals. The experimental work described in the following pages was performed to evaluate the most promising of these products.

DISCUSSION

5. Plastic Resin Materials:

a. The only commercially-available product in this class is the vesicular film manufactured by the Kalvar Corp. It consists of a diazonium salt finely dispersed in a very thin coating of a thermoplastic resin on a paper or film support. Upon exposure to ultraviolet light, the salt decomposes, releasing nitrogen gas within the plastic layer. The gas will gradually escape to the surface, unless subjected to heat "development" which causes the gas to collect in microscopic bubbles which are then bound by the surrounding resin.

b. When the developed bubble-image is illuminated, optical density results through scattering and refraction of some of the light rather than the absorption of light as is the case with silver or dye images. The measured density is a function not only of the bubble population in a given area, but also of the viewing conditions. The angles which the light source and the light detector subtend at the film must be controlled.

c. For optimum viewing, specular illumination perpendicular to the plane of the film is required. At very low angles of illumination there is an apparent reversal of the polarity of the print, as illustrated in Figure 1. Diffuse illumination causes an increase in the light scattering within the image, lowering apparent contrast and otherwise degrading the image quality. One phenomenon of particular significance in the "viewing adjacency effect": as light is scattered within an image element, some of the deflected rays enter adjoining image elements, adding to that received directly from the primary light source. Further loss in apparent image contrast is thus incurred, and a true assessment of image density is difficult to obtain.

d. Reportedly, Kalvar films are capable of resolutions in the order of 200 lines per millimeter. However, the size of the bubbles forming an image can vary from 0.5 to 5.0 microns, depending on the exposure and processing conditions and upon the nature of the image being reproduced. Both exposing and processing should be accomplished in the shortest possible time and at the lowest practical temperature to achieve the higher resolutions.

e. Experimental investigation for the subject at hand has been confined primarily to the reversal-type Kalvar films, Types 50 and 80. The latter is "processed" by a high-intensity actinic flash rather than by heat; however, there was no success in producing an image of usable density. Partial success was had with the Type 50 film although here, too, the maximum density achieved was relatively low. One of the fundamental difficulties with this type is that reversal of the image is accomplished by "de-gassing" the latent image from the first exposure, followed by a second over-all exposure which must not be allowed to de-gas before processing. However, de-gassing is so spontaneous and rapid that control is critical and difficult. Using a Kalvar

FIG. 1

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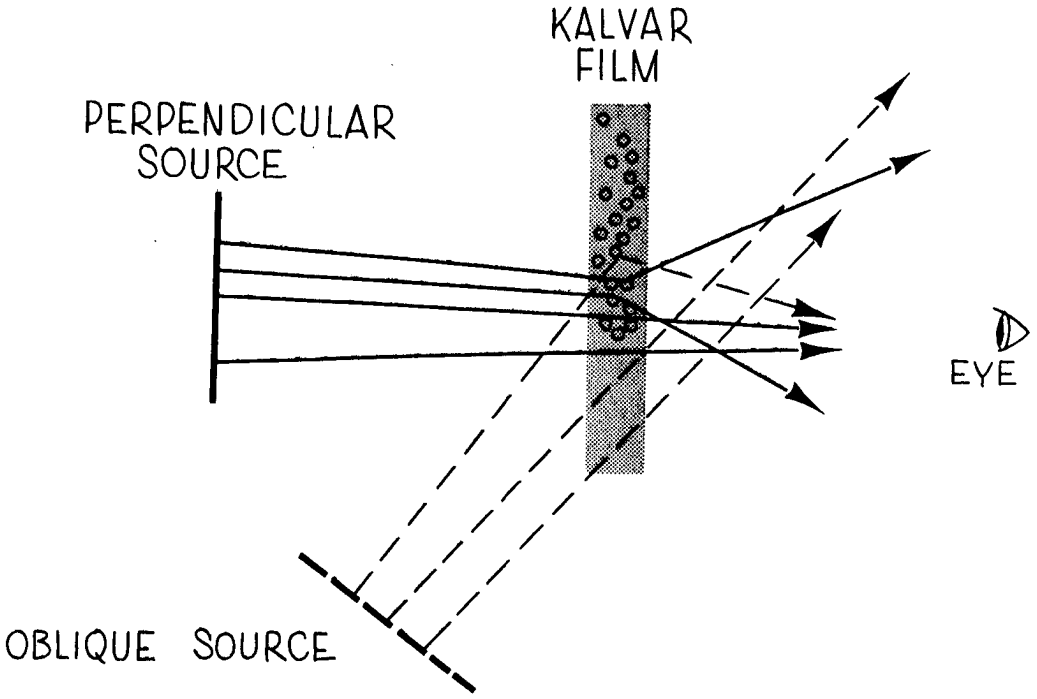
PAR 203
1 JULY '65

KALVAR FILM VIEWING EFFECTS



PERPENDICULAR SOURCE :

DEVELOPED AREAS APPEAR DARKER
THAN UNDEVELOPED AREAS

OBLIQUE SOURCE :

DEVELOPED AREAS APPEAR LIGHTER
THAN UNDEVELOPED AREAS

SECRET

"Kalcon 201" exposing-processing unit, the best images produced from typical aerial photographs had so little visual density as to be barely recognizable and, therefore, of little photo-intelligence value.

6. Diazo Films:

a. Basically, these materials consist of a diazonium salt and an organic coupling compound mixed together in a very thin coating on a film support. Both chemical types can be had in many specific compounds so that a wide variety of physical and photographic characteristics is possible. Often a blend of several compounds is used to achieve specific end results. Spontaneous coupling of the diazonium salt and the coupler to form a colored dye is prevented by an acidic material incorporated in the coating.

b. When ultraviolet light strikes a molecule of a diazonium salt, or "diazo", decomposition takes place and an inactive colorless compound results. The unexposed diazo molecules remain active and will readily combine with the coupler whenever the acidic "stabilizer" is neutralized. This is accomplished in processing simply by subjecting the exposed film to ammonia vapor for a few minutes. A stable dye results, in amounts directly proportional to the amount of light-absorbing density in the photographic material being printed.

c. Several manufacturers market diazo films which apparently fulfill the basic requirements of this PAR. A number of these were briefly tested for suitability, particularly with respect to image hue, photographic contrast, and the maximum and minimum densities obtainable. Sensitometric curves are shown in Figure 2, and other observed characteristics in Table 1.

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1 July 6

PAR 203

Emulsion DIRECT-REVERSAL DIAZO FILMS

EXPOSURE G.E. 100 WATT MERCURY VAPOR

Sensitometer SILVER TABLET

Exposure Time 2 MINUTES AT 3 INCHES

PROCESSING AMMONIA VAPOR

FIGURE 2

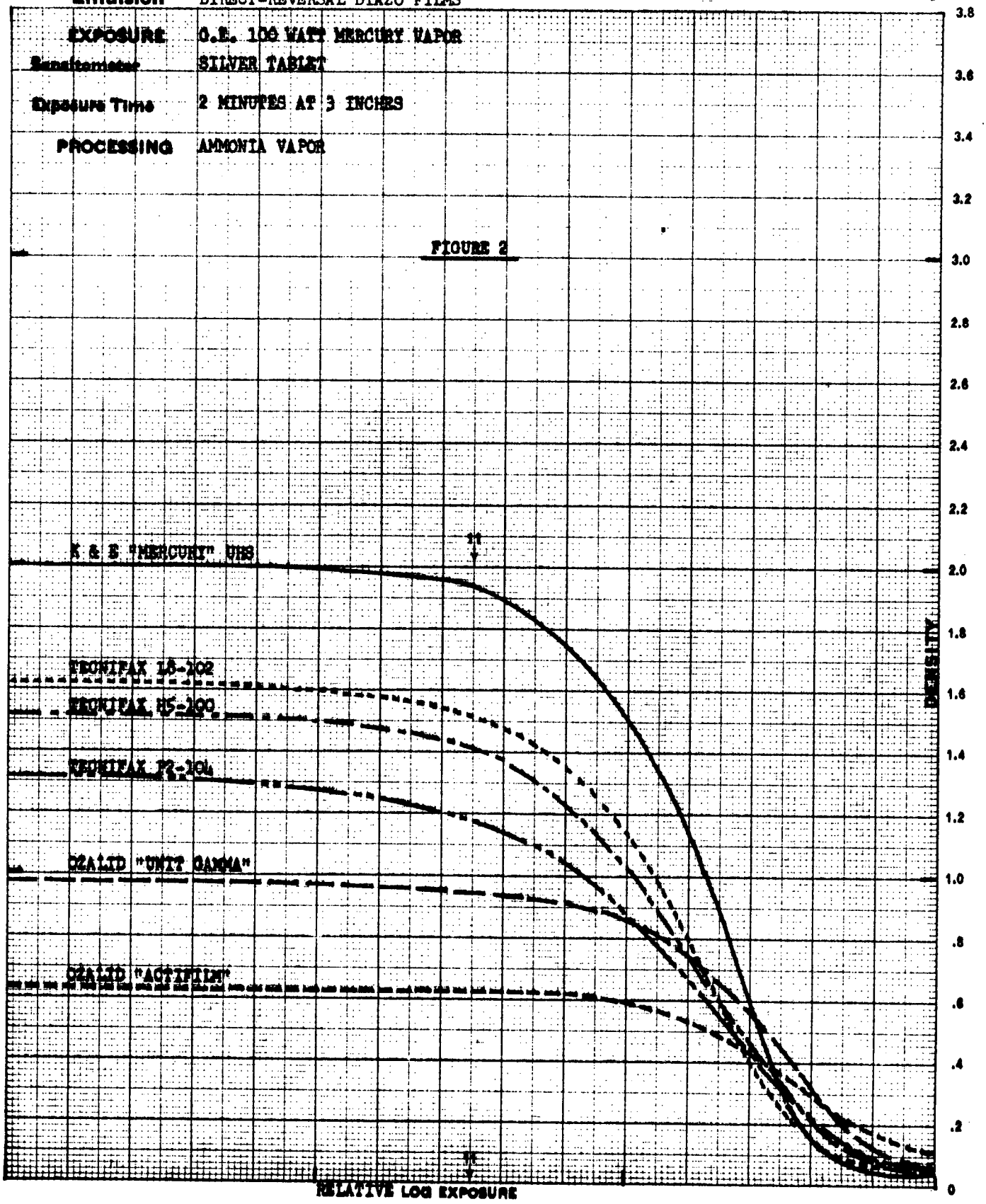

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Table 1. Observed Properties of Various Diazo Films

	Ozalid Actifilm	K & E "Mercury"	Tecnifax H5-100	Tecnifax P2-104	Tecnifax L8-102	Ozalid Unit-Gamma
Color	Purple-Gray	Deep Blue	Green-Gray	Yellow-Green-Gray	Blue-Purple	Yellow-Red-Gray
Log Exposure Scale	0.55	1.06	1.20	1.40	1.12	0.80
Fog	0.10	0.04	0.04	0.06	0.06	0.06
D-Max	0.63	2.00	1.52	1.32	1.62	0.98
Gamma	0.70	2.97	1.39	1.13	1.95	1.21
Speed	All approximately 1/100 - as fast as slowest high-resolution silver emulsions					
Sensitivity	3000 to 4500 angstroms					
Resolution	Theoretically capable of over 1,000 lines per millimeter					
Support	Clear acetate and/or butyrate; mylar may be available					
Processing	Ammonia vapor					

d. From the preliminary testing, two of the diazo films appeared to be significantly superior to all the others: Ozalid "Unit Gamma", and Tecnifax "K-Tone" Type H5-100. Both have a fairly low fog level, good sensitometric curve shape, and near-neutral color. The Ozalid product does not have as high a maximum density nor as long a Log Exposure Scale as the Tecnifax product. Therefore, only the Tecnifax K-Tone was subjected to the complete testing outlined in the PAR.

e. In the following section are comments and results of all the tests performed on one or both of the selected diazo films; Table 2 summarizes the photographic and operational characteristics of Tecnifax K-Tone Film for the purposes of this PAR.

7. Results of Testing:

a. Spectral Sensitivity: Diazo films, in general, have their principal sensitivity in the actinic region of the spectrum, from 3,000 to 4,500 Angstroms. The peak sensitivity of K-Tone is at 3,950, which is close to the peak emission of high-pressure mercury vapor lamps (see Figure 3). There is some shift in sensitivity during the course of exposure due to chemical decomposition, but this is of no practical concern.

b. Sensitometric Characteristics: Even those diazo images which appear neutral in color are mixtures of several dyes; therefore, they are spectrally selective and cannot be measured as simply as are silver images. As an approximation, however, one manufacturer recommends that densitometry be accomplished on a Macbeth QuantaLog, Model TD-102, through a green filter, Wratten No. 93. This was done for all diazo products herein reported.

Table 2

Properties and Operational Features of
Tecnifax K-Tone H5-100 Diazo Film

A.	Color	Nearly neutral, with a green cast
B.	Log Exposure Scale	1.20, measured from 0.1 above gross fog to 0.1 below D max
C.	Density Range	Fog = 0.04, D max - 1.52
D.	Contrast	Mid-scale gamma measures 1.39 when exposed to a silver step tablet by a mercury-vapor lamp.
E.	Speed	Very slow; using a bare 100 watt mercury-vapor lamp three inches from a typical silver aerial transparency, a contact-exposure of two minutes is required.
F.	Photographic Quality	In general, comparable with a silver reproduction.
G.	Exposure Determination	Readily estimated after brief experience; can be established by densitometric calibration if desired.
H.	Processing	Expose to ammonia fumes four to five minutes; very non-critical.
I.	Production Rate	Depends on size of lamp used and size print desired. See item E above.

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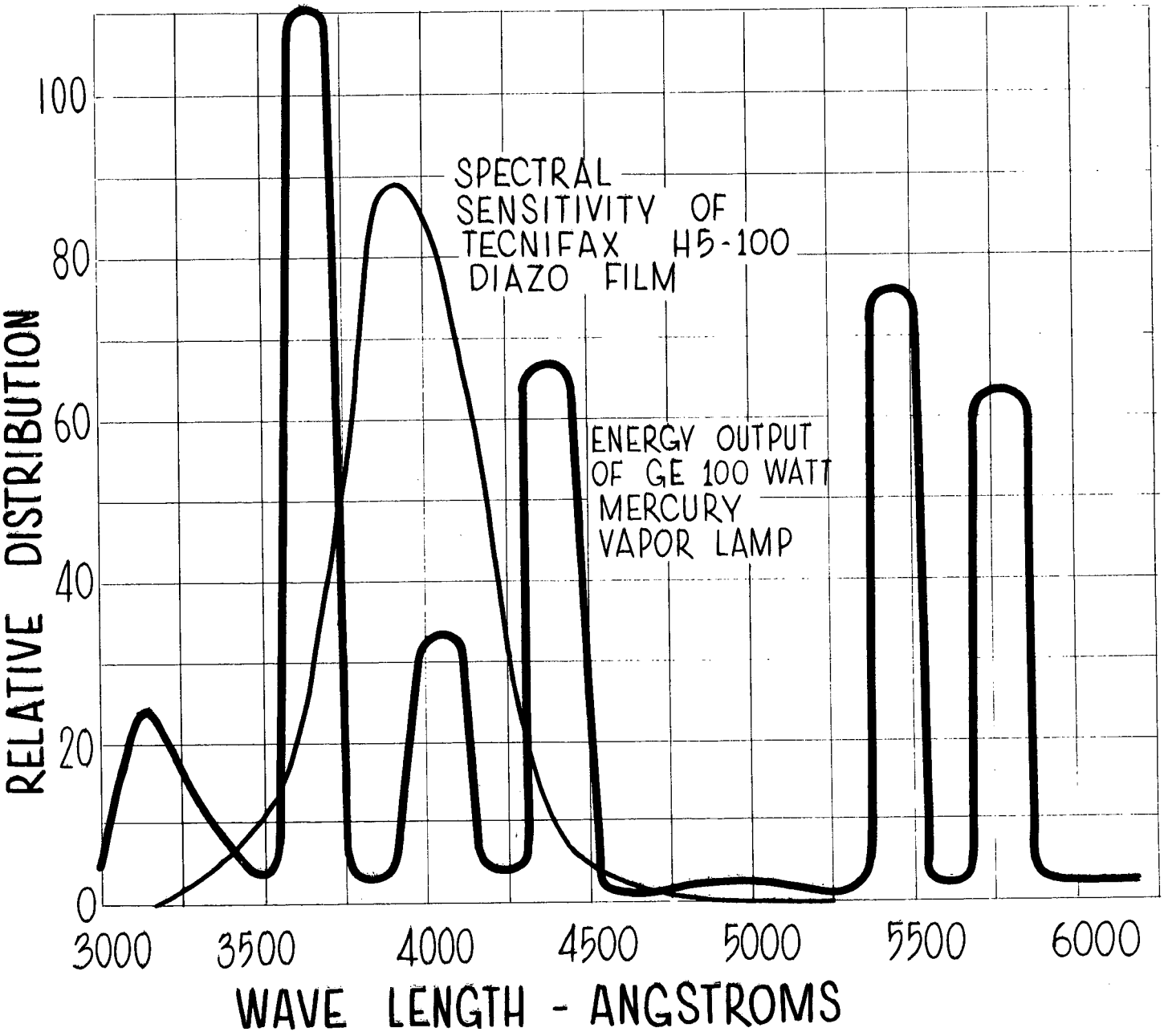
1 JULY '65

FIG. 3

SPECTRAL SENSITIVITY & EXPOSURE of TECNIFAX H5-100 DIAZO FILM



c. Log Exposure Scale: The nearly-linear portion of the sensitometric curve, measured from 0.10 density above gross fog to 0.10 density below D-max, measures 0.80 Log E for Ozalid Unit-Gamma and 1.20 Log E for Tecnifax K-Tone. The D-max of the two products averages, respectively, 0.98 and 1.52. The tone reproduction capabilities of Tecnifax K-Tone are therefore superior to those of Ozalid Unit-Gamma.

d. Contrast: The measured photographic contrast of Ozalid Unit-Gamma is 1.00 as the name implies, but because of its relatively low maximum density it appears somewhat "flat". Tecnifax K-Tone has a measured gamma of 1.30 and, coupled with an appreciably higher maximum density, has a sharper, more brilliant appearance. This higher contrast is probably not detrimental as long as succeeding generations are not to be produced. Sensitometric curves of the two products are shown in Figure 4.

e. Photographic Speed:

(1) Diazo films are, in general, only about 1/100 as fast as the slowest high-resolution silver halide spectrographic emulsions, but by using high-intensity mercury vapor lamps or carbon arc illumination, exposures as fast as 1/10 second have been used.

(2) The energy required for exposure of Tecnifax K-Tone, as determined by the manufacturer, is 0.965 watt-sec./cm^2; however, the source is not specified. Under the conditions of the experimental studies, exposures of two minutes were required when using a bare 100-watt mercury vapor lamp four inches from the exposure plane.

f. Image Quality (Hue): Both diazo films when viewed over fluorescent illumination, are more-or-less neutral until compared side by side. Then, it is apparent that the Ozalid Unit Gamma is somewhat yellow-red

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1 July 65

Emulsion SELECTED DIRECT-REVERSAL DIAZO FILMS PAR 203

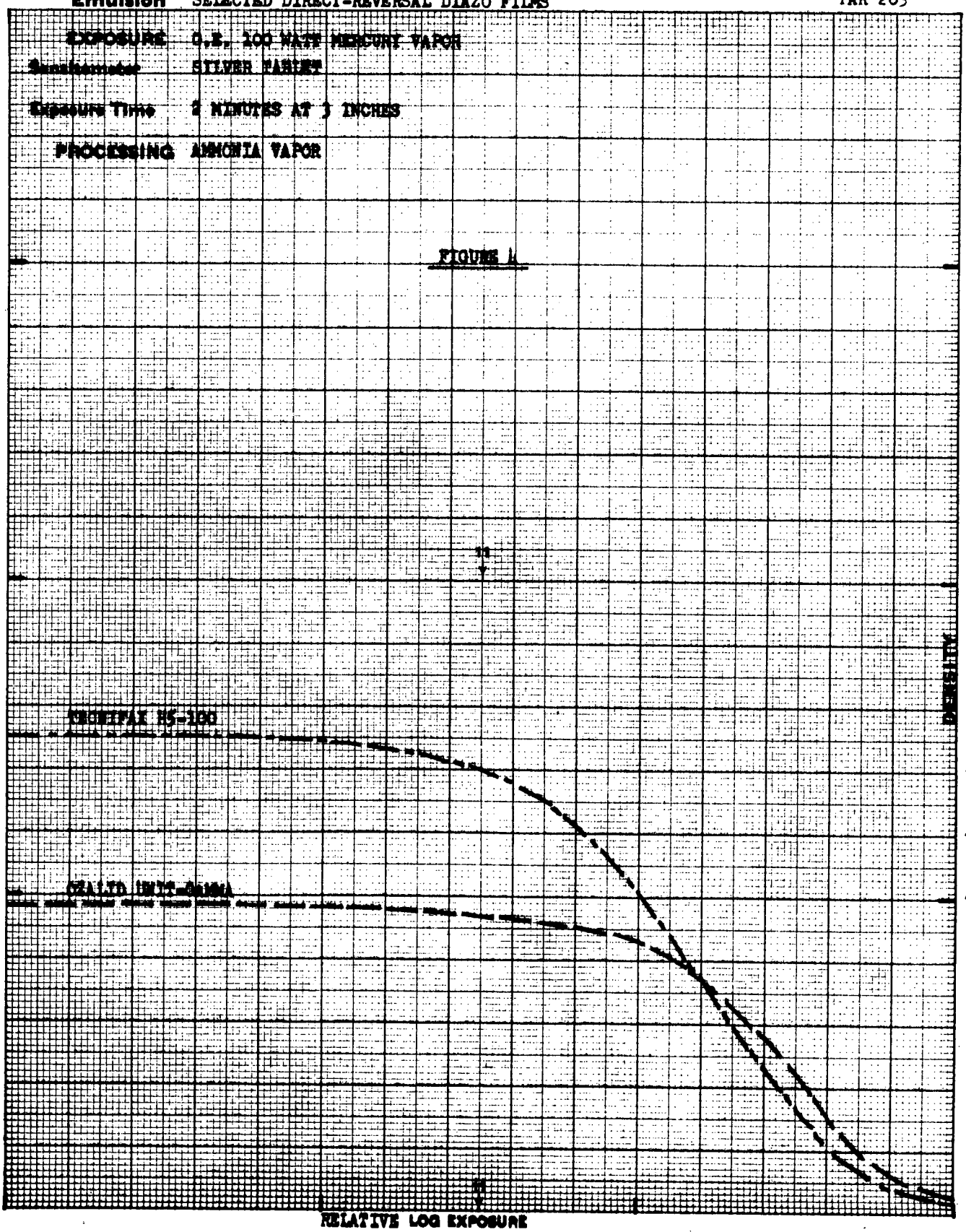
EXPOSURE U.V. 100 WATT MERCURY VAPOR

Sensitometer SILVER HARDER

Exposure Time 2 MINUTES AT 3 INCHES

PROCESSING AMMONIA VAPOR

FIGURE 1



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while Tecnifax K-Tone is slightly yellow-green. Small hue differences from minimum to maximum densities may also be detected. However, none of these departures from true neutrality seem to be of significance.

g. Resolution: Diazo images consist of individual dye molecules rather than silver particles. Even in ultra-fine grained silver emulsions of the Lippman type, the average developed grain clump is 200 times larger than the diazo molecules. Therefore, resolution exceeding 1,000 lines per millimeter should be attainable. A possible problem accompanying such resolution could be the occurrence of "half-tone mottle" or "contact measles", resulting from resolving the actual grain structure of the silver original photography. However, none was noted in the course of our studies.

h. Dye Stability: Separate fading tests were run on processed diazo samples using tungsten and fluorescent illumination. Intensities were comparable with those in average office areas. The tests continued for an equivalent of 100 hours, or a total of 10,000 foot-candle-hours for both types of illumination. Because of different degrees of fading for each dye component, test samples were densitometered through red, green and blue filters to more correctly monitor the changes as they occurred. Although samples at the conclusion of the test were not of quite the same hue as when freshly processed, the net loss in density was only approximately 0.20 and the image degradation appeared to be insignificant (see Figure 5).

i. Reproducibility of Results:

(1) Ten successive prints from the same lot of film showed a density range equivalent to less than 0.08 Log E among all samples. Since this is equal to only approximately one-quarter stop exposure variation, it should be of little concern. Lot-to-lot variability was not thoroughly

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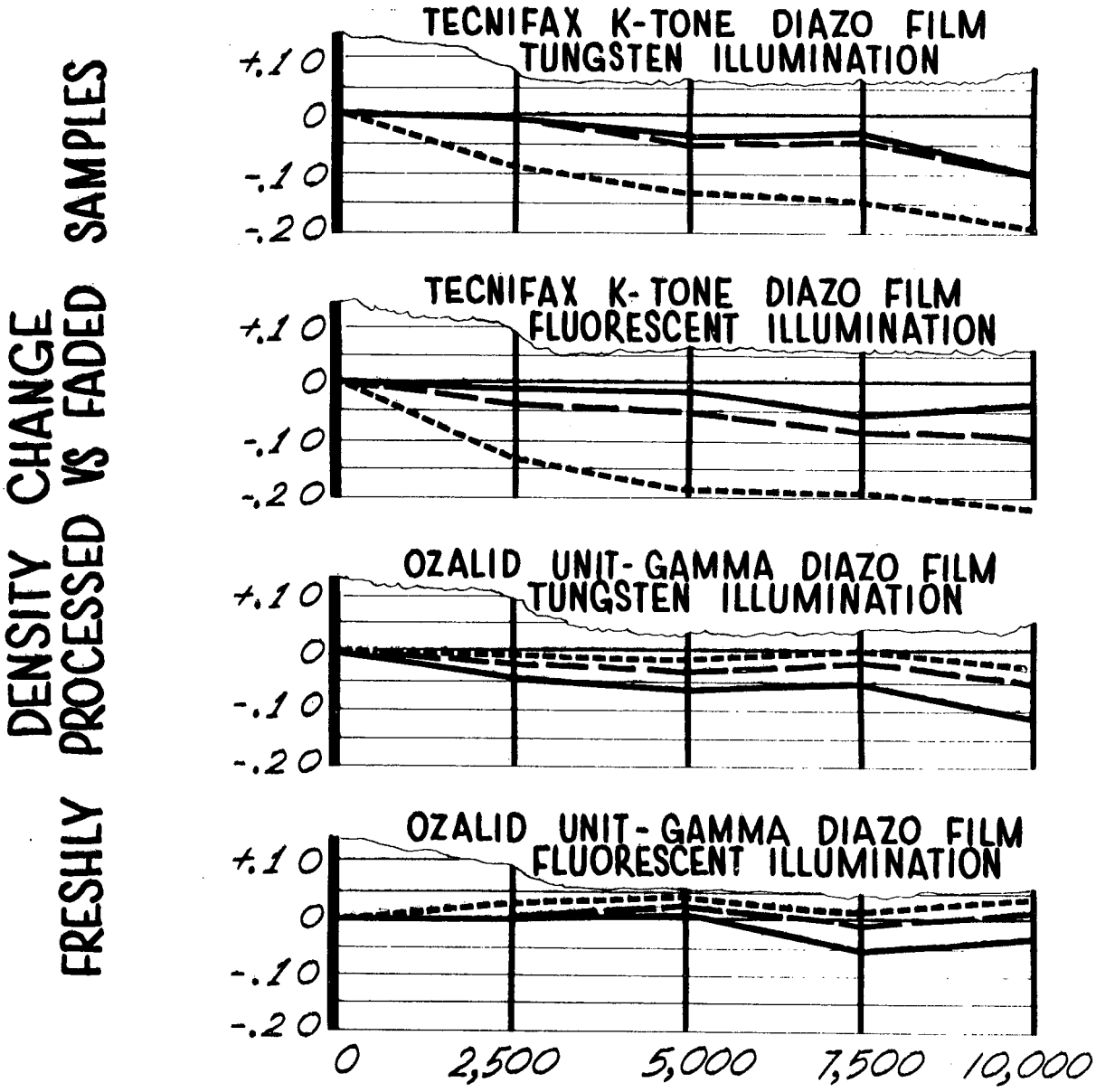
PAR 203
1 JULY '65

FIG. 5

FADING OF PROCESSED DIAZO FILM



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documented, but three lots used in our investigation had approximately the same average printing speed. Minor adjustments in exposure times could be made if significant lot-to-lot variability were encountered.

(2) Included in the variability noted above would be any attributed to processing effects. Because diazo processing is "to completion", there should be no discernible processing variability as long as a specified minimum time plus a small safety factor is observed.

j. Latent Image Stability: Because rapid-access is one of the fundamental requirements of the study, it would be expected that little time would elapse between exposing and processing each reproduction. However, tests were conducted, for periods up to one hour, and no latent image loss was detected. The latent image in a diazo emulsion is an inactive chemical compound which differs structurally from the unexposed diazo molecule, so there is reason to believe the post-exposure stability might be essentially indefinite.

k. Room Light Tolerance: Testing was performed in areas of typical office brightness, with both tungsten and fluorescent illumination. Brightness was measured by an ordinary light-intensity meter. With either illumination 200 foot-candle-minutes is a fully safe exposure level. Bright office areas are thus safe for nearly two minutes, and more dimly lit work areas for a much longer time.

l. Dimensional Stability: Tecnifax K-Tone Diazo Film, Type H5-100, is coated on a 5-mil cellulose diacetate support. It was deemed impractical to conduct the extensive testing necessary to precisely define the physical stability characteristics of this material. However, it may be assumed that, in general, the various physical factors will be similar to those of typical silver halide films on acetate support.

m. Multi-Generation Duplication: Should it be desired, succeeding generations of prints can be produced on diazo film from a diazo "original". Because of its nearly 1.0 gamma, Ozalid Unit Gamma film might be the better choice for such printing simply to maintain the mid-scale contrast of the original. However, if some increase in contrast is tolerable the Tecnifax K-Tone film will yield a longer tonal scale and better "blacks."

CONCLUSIONS

8. Diazo films are the only photographic materials, currently commercially available, which fulfill the requirements of a rapid access printing system as defined in this PAR. Tecnifax K-Tone Diazo Film, Type H5-100, and to a lesser extent, Ozalid Unit Gamma Diazo Film, perform quite well in nearly all respects. Their only major shortcoming is the very slow photographic speed, far below that necessary for convenient safe handling in normal room illumination. An illumination source rich in ultraviolet light must be used, and high-pressure mercury-vapor lamps fulfill the requirements very well. Small lamps rated at only 100 watts may be used if exposures of up to five minutes can be tolerated to produce a 4 x 5 inch reproduction of typical aerial photography. For larger-size reproductions, or to reduce the exposure time, lamps of up to at least 1,000 watts are commercially available. Therefore, the slow photographic speed of the diazo film may be offset by proper choice of the illumination system.

9. Based on the results of this investigation it is felt that, once the operator's requirements are defined, it should be possible to design and fabricate a rapid access printer suitable for use as a photo-interpretation tool.

RECOMMENDATIONS

10. As a result of this investigation and recent discussions with customer representatives, it is recommended that a prototype rapid-access printing system be designed, fabricated and tested.

11. Recommended design guidelines for this prototype equipment would include:

a. Tecnifax H5-100 diazo film in 4" x 5" or 5" x 7" size as sensitized material to be used.

b. Exposure by high-pressure mercury vapor lamps.

c. Processing by ammonia vapor.

d. Incorporation of printing and processing equipment into a work table of such design that viewing, PI work, and selective rapid-access printing can be done sequentially.

e. Print production rate of approximately one per minute.

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MONTHLY REPORT

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PAR 203

30 June 65

SUBJECT: Rapid Access Printer

TASK/PROBLEM

1. To investigate commercially available continuous tone, dry or semi-dry, printing systems with the view of designing and fabricating a rapid access printer that can be used to reproduce photographic materials in photo interpretation areas under normal room lighting conditions.

DISCUSSION

2. A report of all experimental work performed to date is currently underway. The completed report is slated to become either an Interim or a Final Report, when and as directed by the customer.

PLANNED ACTIVITIES

3. Finalizing the report, as discussed above, will continue.

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GROUP 1
EXCLUDED FROM AUTOMATIC DOWNGRADNG AND DECLASSIFICATION

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25X1

FY-65 Quarterly Report, No. 4

PAR 203
28 May 65

SUBJECT: Rapid Access Printer

TASK/PROBLEM

1. To investigate commercially available continuous tone, dry or semi-dry, printing systems with the view of designing and fabricating a rapid access printer that can be used to reproduce photographic materials in photo interpretation areas under normal room lighting conditions.

DISCUSSION

2. Experimental effort on currently available commercial materials has been completed, and all results are being summarized for interim or final reporting. Only one photographic product, Technifax "K-Tone" Diazo Film, fulfills the requirements of the PAR but it does so quite well.

PLANNED ACTIVITIES

3. Report preparation will continue, resulting in either an Interim or a Final Report, as directed by the customer. Included will be recommendations applicable to the suggested Phase II study, "design, fabricate, and test prototype equipments as directed by the customer."

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MONTHLY REPORT

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PAR 203

3 May 65

SUBJECT: Rapid Access Printer

TASK/PROBLEM

1. To investigate commercially available continuous tone, dry or semi-dry, printing systems with the view of designing and fabricating a rapid access printer that can be used to reproduce photographic materials in photo interpretation areas under normal room lighting conditions.

DISCUSSION

2. Experimental effort on Phase I of this PAR is essentially complete. Only one commercially-available material, Technifax K-Tone Diazo Film, meets the known requirements, but it does so quite well. The other diazo materials tested suffer from high contrast, short exposure scale, and/or low maximum density. All are quite slow, but this shortcoming can be overcome by increased illumination levels.

3. The plastic resin reproduction materials, typified by the various Kalvar products, are unsatisfactory in several respects. As stated in last month's report, work on these products was terminated.

PLANNED ACTIVITIES

4. All test results generated to date are being assembled and summarized in an interim report. Although there are no additional known products on the market potentially suitable for this PAR, it may be desirable to withhold final action for an additional period of time. However, except for the interim report, no further activity is planned.

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MONTHLY REPORT

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PAR 203
31 Mar 65

SUBJECT: Rapid Access Printer

TASK/PROBLEM

1. To investigate commercially available continuous tone, dry or semi-dry, printing systems with the view of designing and fabricating a rapid access printer that can be used to reproduce photographic materials in photo interpretation areas under normal room lighting conditions.

DISCUSSION

2. Through direct customer-contractor communication, the contractor was directed to investigate only those reproduction systems which yield a high-quality positive transparency from a positive image.

3. The two Kalvar films which meet the basic restrictions of the PAR have been received and partially tested. Malfunctioning of the Kalvar "Kalcon 201" exposing-processing unit has caused several delays but the unit is now operative. Test results to date are as follows:

a. Kalvar Type 50 Film is a reversible direct-image vesicular film requiring only heat for processing. The first-exposure negative image is eliminated by "degassing," which is a brief aging process during which the gaseous latent image diffuses out of the binding medium. A second exposure produces a positive latent image, which will also be rapidly degassed if not quickly stabilized. There was only partial success in achieving the briefness and intensity required for such an exposure. The product has a very low maximum density and only about 0.6 log exposure scale, when viewed over a diffuse fluorescent light source.

b. Kalvar Type 80 Film is a reversible direct-image vesicular film which is processed by a second exposure to an ultraviolet gas discharge lamp. Brief testing to date has yielded very poor images, perhaps due to

a shortage of UV light caused by the plastic shield permanently mounted over our Xenon lamps.

c. Since the Kalvar films produce an image by scattering rather than absorbing light, the apparent image density is strongly influenced by the type of illumination. The effect can be so pronounced as to cause a positive image to appear negative by simply changing from perpendicular to oblique lighting. This fact, plus the non-homogeneous nature of the image, indicates that this type of product is unsuitable for conventional photo interpretation purposes and further effort will be terminated.

4. In addition to the testing of Kalvar films reported above, we have also investigated some of the image stability properties of two diazo films: Ozalid Unit Gamma, and Technifax K-Tone H5-100. Fading tests under office-type illumination, both fluorescent and tungsten, indicate a possible density loss of 20 percent in 200 hours. Generalizations, however, are complicated by the fact that the two films behave differently under each fading condition and undergo different changes in image hue.

PLANNED ACTIVITIES

5. Further quantitative data on diazo fading will be obtained to document the minor post-processing precautions which may be advisable.

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QUARTERLY REPORT

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25X1

PAR 203

26 Feb 65

SUBJECT: Rapid Access Printer

TASK/PROBLEM

1. To investigate commercially available continuous tone, dry or semi-dry, printing systems with the view of designing and fabricating a rapid access printer that can be used to reproduce photographic materials in photo interpretation areas under normal room lighting conditions.

DISCUSSION

2. The major experimental effort this quarter has been directed toward the direct-reversal diazo films currently marketed by several manufacturers. Following perusal of technical literature available to date, six varieties of diazo films have been subjected to at least preliminary study. Three of these are made by Technifax Corporation and are in their "K-Tone" or "Poly-Tone"line; two are made by Ozalid; the third is marketed by Keuffel and Esser Co.

3. The attached graph (Figure 1) of sensitometric curves indicates the tone-reproduction capabilities of the six diazo films tested. Both Ozalid films are rather low in contrast and quite low in shadow density, yielding a very condensed tone scale. The K&E film, on the other hand, has a desirably high shadow density (D max) but also a very high contrast. Exposure of this material is quite critical, and subtle density gradients in the original photography are readily lost in the diazo reproduction.

4. All three of the Technifax diazo films are superior to the other two brands, with the H5-100 variety, in particular, having a very good curve shape. All densitometry has been performed per the manufacturer's recommendations, i.e.,: MacBeth Quanta-Log Densitometer, Model TD-102, using a green filter, Wratten No. 93. A study of the amount of original subject detail retained in the reproduction has not been completed, but the Technifax H5-100 can be expected to perform better than the other diazo films tested.

Emulsion DIRECT-REVERSAL DIAZO FILMS

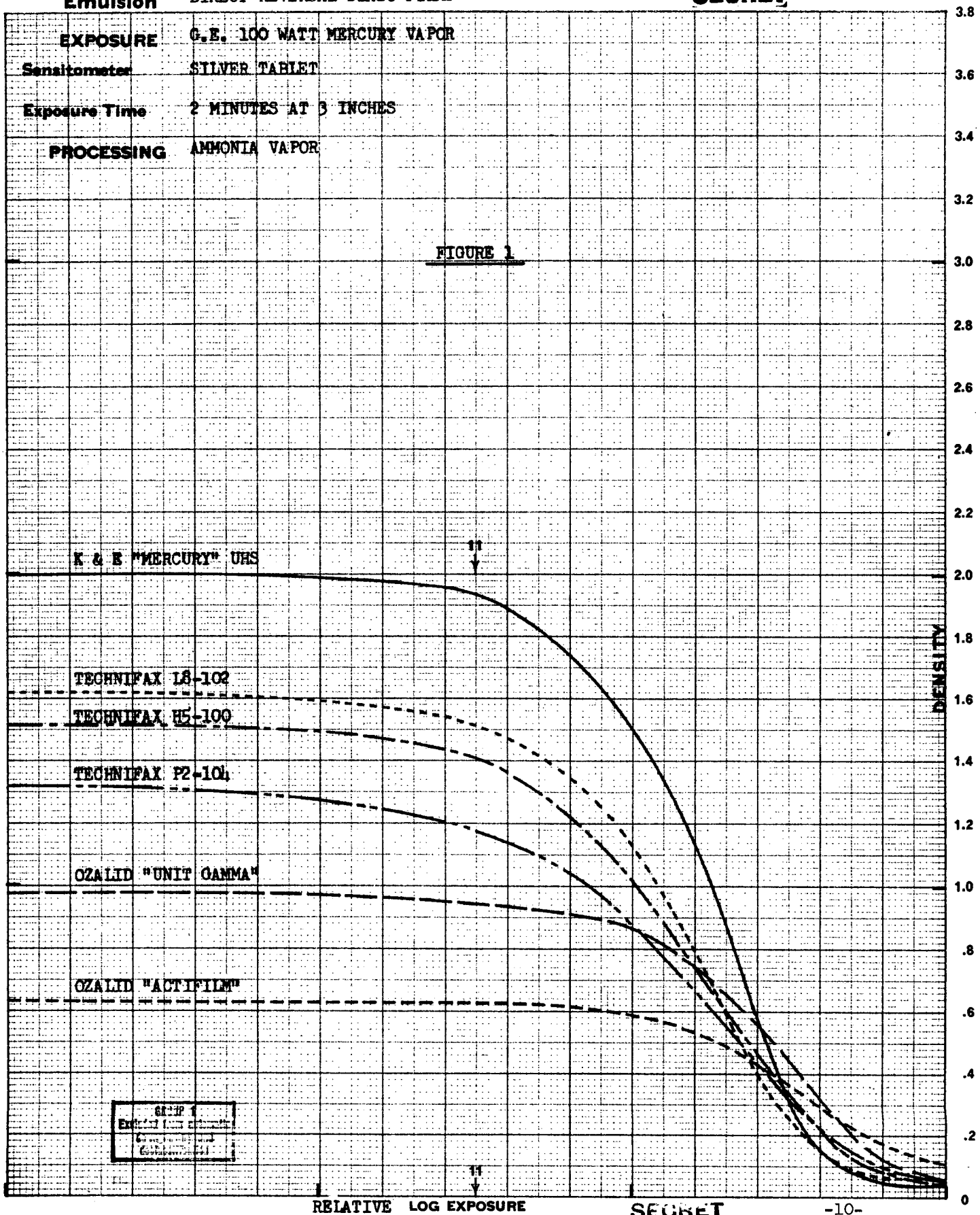
EXPOSURE G.E. 100 WATT MERCURY VAPOR

Sensitometer SILVER TABLET

Exposure Time 2 MINUTES AT 3 INCHES

PROCESSING AMMONIA VAPOR

FIGURE 1



5. Additional technical literature is being sought on thermographic, electrostatic, xerographic, and photo-conductive systems, although none of these appear to be especially promising. The Kodak Bimat system, and Polaroid photography, have some attractive features but may not fulfill all the requirements of the PAR. Similarly, brief testing has been conducted on Kodak Studio Proof and Kodak Professional Proof Papers. These, too, have some assets and several liabilities.

PLANNED ACTIVITIES

6. Three of the newest Kalvar plastic resin products are scheduled for evaluation within the next few weeks. They reportedly are improvements over an earlier variety which our tests indicated was unacceptable for the requirements of this PAR.

7. The PAR calls for an extensive series of tests on each product approved for testing, and all are important where the product appears promising. We have not yet performed all tests on the diazo films discussed above, and recommend that this requirement be withdrawn for any product found seriously deficient during initial testing.

MONTHLY REPORT

[redacted]

25X1

PAR 203
22 Jan 65

SUBJECT: Rapid Access Printer

TASK/PROBLEM

1. To investigate commercially available continuous tone, dry or semi-dry, printing systems with the view of designing and fabricating a rapid access printer that can be used to reproduce photographic materials in photo interpretation areas under normal room lighting conditions.

DISCUSSION

2. Reproducibility tests of Technifax K-Tone diazo film are showing about 0.10 Log E variability from day to day. While this is not serious as far as general photographic quality is concerned, it may, under some circumstances, somewhat degrade resolution. A brief repeat series will be run as soon as a new batch of film is received.

3. Discussions with personnel in the contractor's research facilities confirm our findings to date on commercially available diazo materials; i.e., Technifax K-Tone is superior to other varieties tested for continuous-tone reproduction. Shortcomings found in other materials include short tone-scale and/or very high contrast. However, there reportedly are new diazo products reaching the markets which bear investigation.

PLANNED ACTIVITIES

4. Investigation of Kalvar film is still being delayed by a power-supply problem with the processing unit. It is hoped this will be remedied soon, and that a supply of recent Kalvar emulsions will have arrived for testing.

5. With the testing of authorized diazo materials well advanced, we are awaiting technical information on other varieties for possible detailed investigation. In accordance with the terms of the PAR, actual experimental effort will not be expended without customer approval.

6. The search for other possible reproduction materials will continue.

[redacted]

25X1

PAR 203
24 Dec 64

SUBJECT: Rapid Access Printer

TASK/PROBLEM

1. To investigate commercially available continuous tone, dry or semi-dry, printing systems with the view of designing and fabricating a rapid access printer that can be used to reproduce photographic materials in photo interpretation areas under normal room lighting conditions.

DISCUSSION

2. Sensitometric testing of Ozalid Unit Gamma Film and three types of Technifax K-Tone diazo materials has continued using the 100-watt G.E. mercury lamp, No. H100-A4T. Although long-term reproducibility tests have not been completed, one of the four, Technifax K-Tone H5-100, appears to be significantly superior. The only major shortcoming, apparent at present, is its very low photographic speed, which is characteristic of all current diazo materials in its class.

3. Technical literature is now being sought from manufacturers of diazo materials as well as manufacturers of other reproduction systems such as thermographic, electrostatic, and xerographic. A cursory review has also been made of the Kodak BIMAT system and Polaroid materials. Nothing very promising has, to date, been found.

4. As a result of a contact made several months ago with one of the major lamp manufacturers, an experimental fluorescent lamp was presented for our evaluation. It has a greatly increased UV output plus an internal reflector system which concentrates the emission into a restricted beam. A simple printing-speed comparison between the experimental lamps and a 100-watt mercury discharge lamp was made using Technifax material. For very small area exposures, the mercury lamp is obviously superior. However, for print sizes of 8 x 10 inches or larger, the experimental fluorescent lamps may be as efficient and perhaps more desirable.

Further testing of this lamp is not contemplated; however, the information is included for further investigation in possible future prototype equipment efforts.

PLANNED ACTIVITIES

5. Reproducibility and photographic quality will be further examined on the Technifax diazo H5-100 material.

6. As manufacturers' technical data becomes available, various products will be screened for suitability.

7. Appropriate units of other divisions of the contractor's organization will be contacted for their knowledge of, and experience with, diazo and other reproduction systems.

25X1

PAR 203
30 Nov 64

SUBJECT: Rapid Access Printer

TASK/PROBLEM

1. To investigate commercially available continuous tone, dry or semi-dry, printing systems with the view of designing and fabricating a rapid access printer that can be used to reproduce photographic materials in photo interpretation areas under normal room lighting conditions.

DISCUSSION

2. Experimental efforts to date have been directed largely toward the evaluation of light sources. Several very small lamps were briefly tested until it was found that their ultraviolet output was too low to be practical; these included:

a. GE 2.5-watt argon lamp
b. Spectroline SL-2537 low-pressure mercury lamp
c. GE fluorescent lamps, No. BL

A somewhat more powerful fluorescent lamp, GE No. BLB, also was tested briefly and perhaps would be usable if provided with suitable reflectors.

3. Two lamps were found which approximate the lower limit for very slow materials such as diazo films. These are:

a. GE 100-watt mercury lamp No. H100-A4/T
b. Sylvania 675-watt "Sun Gun" tungsten lamp

Both give adequate exposure of diazo films through a typical positive transparency in less than two minutes. Larger mercury lamps, such as the 250- or 400-watt sizes, would reduce the exposure time but would increase heat output and consequently introduce possible problems.

4. Since the primary objective of this PAR is to evaluate possible print materials, little additional effort will be expended on lamp evaluation. Present plans are to use the 100-watt mercury lamp for all subsequent sensitometric testing of the light sensitive materials.

5. Print materials currently being tested include ozalid Unit Gamma Film, and three varieties of Technifax K-Tone Film. Evaluation of Kalcon Film has been delayed because of power-supply wiring changes needed in the exposing-processing unit.

PLANNED ACTIVITIES

6. The materials currently on hand will be subjected to complete sensitometric evaluation as specified in the PAR.

7. Consideration will be given to other print materials appropriate to this study. Customer approval will be requested to evaluate such materials if they appear promising.

8. Rough sketches of briefing aids will be prepared and forwarded to the customer.

MONTHLY REPORT

[redacted]

25X1

PAR 203
30 Oct 64

SUBJECT: Rapid Access Printer

TASK/PROBLEM

1. To investigate commercially available continuous tone, dry or semi-dry, printing systems with the view of designing and fabricating a rapid access printer that can be used to reproduce photographic materials in photo-interpretation areas under normal room lighting conditions.

DISCUSSION

2. Initial testing of five light sources has progressed to the point where tentative conclusions can be drawn. Using only Technifax H5-100 diazo film to date, the results are as follows:

a. Argon lamps: G. E. 2.5 watt, 110 volt. As was anticipated, the output of ultraviolet light was so low that very long exposures were required.

b. Spectroline SL-2537 miniature mercury lamp: An earlier test, made in a glassless printing system, indicated that exposures of a minute or two might yield satisfactory densities. To achieve better contact between the diazo material and the photographic original, a glass hold-down cover is currently in use. This has resulted in a lengthening of the exposure time that is not satisfactory. Several means of reducing these obstacles will be briefly tested.

c. Blacklight fluorescent tubes: Eight-inch G. E. BLB (Blacklight Blue). Two-minute exposures at a film-to-tube distance of two inches yielded a full-scale exposure. However, without a suitable reflection or diffuser the uniformity of illumination is poor (tubes are spaced on one-inch centers).

d. 100-Watt mercury lamp: Using a bare lamp without reflector or diffuser, and exposing for two minutes at a film-to-lamp distance of three inches, full scale exposures were produced. Uniformity over an area of per-

haps 3 inches by 4 inches appeared satisfactory, and resolution even in a simple holder was at least 250 lines/mm. Suitable reflectors, such as in drum-type continuous printers, should reduce the necessary exposure time and increase the field uniformity. When a small blower is used with the lamp, there does not appear to be a heat problem.

e. Sun Gun - Sylvania 675 watt tungsten lamp: Due to a significant heat output, testing to date has been with a minimum film-to-lamp distance of ten inches. However, at this distance a full-scale exposure can be produced in less than one minute when the lamp is mounted in a small reflector. Resolution of 400 lines/mm has been achieved, and uniformity should be good beyond the 3 inches by 4 inches size noted in d. above. It does not appear practical to supply such a large blower capacity that distances from lamp to film could be significantly reduced from the present ten inches.

3. At this point it appears that the 100 watt mercury lamp could be used in a rather compact portable printer. Two problems are associated with its use:

a. The need of forced air for cooling.

b. The required lamp warm-up of several minutes.

4. The Sun Gun - Sylvania 675 watt tungsten lamp will probably be suitable only in a larger console unit although in this application it has a number of distinct advantages.

PLANNED ACTIVITIES

5. Investigation of light sources was carried out to obtain rough guide lines for the type, size and availability of suitable sources. No further effort on this investigation is planned at this time.

6. Future effort will be concerned with testing and evaluation of the proposed materials from a photographic point of view as outlined in the original PAR, dated 10 April 64.

7. The inclusion of promising new materials in the investigation program will be discussed with the customer prior to actual start of test effort.

25X1

PAR 203

8 Sept 64

SUBJECT: Rapid Access Printer

TASK/PROBLEM

1. To investigate commercially available continuous tone, dry or semi-dry, printing systems with the view of designing and fabricating a rapid access printer that can be used to reproduce photographic materials in photo interpretation areas under normal room lighting conditions.

DISCUSSION

2. Upon approval of this PAR, a search of the technical literature was made to assess capabilities, cost and availability of current commercial equipment. This effort was carried forward concurrently with basic investigations called for by the above TASK/PROBLEM and provided assurance that no usable printing capabilities were overlooked.

3. The following problem/objectives of basic printer design were considered shortly afterward:

a. Operational system requirements.

b. Printer size limitations.

c. Desired print size capacity.

d. Mode of operation desired.

e. Exposure and processing time limitations.

4. Within the knowledge available at this point, the above problem/objectives were used to formulate a detailed outline for work on the project. Areas of investigation planned:

a. Size, capacity and operating speeds of equipment.

b. Materials to be used for testing.

c. Optimum quality values in terms of resolution, speed, contrast and other significant measures of the image, the stability and the reproducibility attainable for the system.

5. Kalvar film and Technifax K-Tone film were procured for testing. A decision was made to concentrate on these two materials for the initial investigations since the third material specified in the PAR, Ozalid Unit-Gamma film, is apparently a near duplication of the Technifax product.

6. Equipment and components were assembled to include:

a. A Kalcon unit for exposing and processing the Kalvar film.

b. A simple breadboard exposing unit.

c. Four test illumination sources.

7. Testing was begun with a low-pressure mercury source to expose Technifax K-Tone film. A 30-second exposure, fairly short for Technifax, yielded an image. While shorter exposures were desired, this result held some promise for usability of a cold running source. Final judgement was withheld, however, since more powerful sources may be required.

PLANNED ACITIVIES

8. Continue testing of illumination sources on the Technifax material.

9. Initiate investigation of the Kalcon unit and Kalvar film.

10. Perform detailed optical and sensitometric testing of the more promising system components and materials as soon as practical selection of these is possible.

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MONTHLY REPORT

[redacted] 25X1

PAR 203

7 August 1964

SUBJECT: Rapid Access Printer

TASK/PROBLEM

1. To investigate commercially available continuous tone, dry or semi-dry, printing systems with the view of designing and fabricating a rapid access printer that can be used to reproduce photographic materials in photo interpretation areas under normal room lighting conditions.

DISCUSSION

2. The major effort expended this period has been on the planning of work to follow. Of major concern are the exact operational requirements of the system in question:

a. Maximum size of print needed.
b. Allowable overall size of the printer.
c. Desired mode of operation.
d. Exposure and processing time limitations, etc.

Utilizing available knowledge from within the contractor's organization, tentative ground rules have been established for these and other basic design parameters.

3. Based on the above, and the other objectives of the PAR, a detailed outline of the investigative program has been prepared. While changes or additions may be made as work progresses, an attempt has been made to cover all aspects of the task. Areas for study covered by the detailed outline:

a. Design, size and capacities of printer and printer components.

b. Operating speeds and related characteristics of the printer and associated print processing.

c. Kalvar, Ozalid and Technifax materials specified in the PAR.

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d. Optimum quality obtainable within the limits imposed by a., b., and c. above. Evaluation of such optimum quality to include:

(1) Contrast.
(2) Speed.
(3) Spectral sensitivity.
(4) Resolution.
(5) Image quality.
(6) Dimensional stability.
(7) Reproducibility of results.

4. Two of the three sensitized materials specified in the PAR (Kalvar film and Technifax K-Tone film) have been obtained. The third (Ozalid Unit-Gamma film) is apparently a near-duplication of the Technifax product; therefore, initial investigation will concentrate on the two materials now on hand. A Kalcon unit for exposing and processing the Kalvar film is on hand, and a simple breadboard exposing unit and four test illumination sources have been obtained.

PLANNED ACTIVITY

5. Initial testing of the usability of the illumination sources on hand will be started; other sources will similarly be checked as they become available. As usable sources are found, more detailed sensitometric and optical testing will be performed.

6. Briefing aids will be prepared for demonstration of major phases of this project.

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MONTHLY REPORT

25X1

PAR 203

10 July 1964

SUBJECT: Rapid Access Printer

TASK/PROBLEM

1. To investigate commercially available continuous tone, dry or semi-dry, printing systems with the view of designing and fabricating a rapid access printer that can be used to reproduce photographic materials in photo interpretation areas under normal room lighting conditions.

DISCUSSION

2. Since approval of the subject PAR on 18 June 64, only a nominal amount of effort has been expended in formulation of project schedule.

PLANNED ACTIVITY

3. During the next period, investigation will be made to determine suitable printing sources by:

a. Investigate and review illumination sources.

b. Fabricate a breadboard exposing device.

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Attachment #2
Rpt. Misc. - 35

11 June 64

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SUBJECT: Quarterly Review Conference - PAR 203 - [redacted] 25X1

25X1 VISITOR: [redacted]

25X1 [redacted]

1. Customer gave verbal approval to proceed with PAR 203. This approval will be followed by a TWX which can be expected early next week.

25X1 [redacted] 9046

2. Customer indicated that we investigate the use of the Technifax Corporation diazo material reported at the International Conference of Photographic Science and Engineering. The paper was entitled "Continuous Tone High Resolution Diazo Reproduction System" (200 l/mm were reported).

3. The customer is primarily interested in positive to positive print systems. Use of a negative positive system is acceptable if it provides a method to the positive prints.

4. The customer would like the capability to make exposures as film is moved over viewing table (light table).

5. Bi-mat materials were mentioned by [redacted] for possible use, but he was told that we did not feel Bi-mat as applicable to PAR 203 as for other investigations now underway. 25X1

[redacted] 25X1

MMB:MSS

GROUP 1
Excluded from automatic downgrading and declassification

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PAR 203-A

RAPID ACCESS PRINTER

10 April 1964

PROJECT AUTHORIZATION REQUEST

PAR 203-A

10 Apr 64

SUBJECT: Rapid Access Printer

TASK/PROBLEM

1. To investigate commercially available continuous tone, dry or semi-dry, printing systems with the view of designing and fabricating a rapid access printer that can be used to reproduce photographic materials in photo interpretation areas under normal room lighting conditions.

PROPOSAL

2. It is proposed that approval be granted to conduct investigations and fabrication of simple breadboard equipments to determine the feasibility of employing commercially available continuous tone, dry or semi-dry, printing materials and/or system in a rapid access printer.

3. Should the results of the proposed investigation reveal a process and/or materials to satisfy requirements stated in paragraph 1, prototype equipments will be designed and fabricated as required and/or directed.

4. It is recommended that the investigation, design and fabrication of prototype equipments, be accomplished in two (2) phases as follows:

a. Phase I:

(1) Conduct a study of commercially available continuous-tone diazo and plastic resin reproduction systems which produce a positive. Other systems may be studied by mutual agreement of the customer and the contractor. The study may require visits to the manufacturer's facility for detail discussion on their equipment and materials.

(2) The specific materials that are known and will be included in the study are Kalcon Film, Ozalid Unit Gamma Film, and Technifax K-Tone Film. The customer will be consulted prior to starting the study of any new material to preclude any duplication of effort and/or unnecessary expenditure of funds.

(3) On a single breadboard that will be fabricated during Phase I, the following characteristics will be evaluated in determining the suitability of each item:

(4) Material properties to include

(a) Log exposure scale

(b) Contrast

(c) Photographic speed

(d) Spectral sensitivity

(e) Resolution

(f) Image quality

(g) Dimensional stability

(h) Reproducibility of results

(i) Room light tolerance

(5) Handling properties to include

(a) Processing device requirements
(b) Exposure device requirements
(c) Exposure determination
(d) Production time

b. Phase II: Design, fabricate and test prototype equipments as directed by the customer to satisfy the requirement as stated in paragraph 1.

PROGRAM OBJECTIVE

5. Program objectives are:

a. Phase I Investigation: A final report will be delivered to the customer six months after receipt of the approval of the study phase. This final report will discuss all materials and approaches studied during the course of the investigation and will contain recommendations for:

(1) Desirability of additional study
(2) Recommendations for prototype equipment

b. Phase II Equipment: Design and fabricate equipment as directed.

SCHEDULE

6. Tentative schedule covering major phases of effort is shown in Figure 1. Schedule for accomplishment of Phase II will be furnished upon completion of Phase I unless requested sooner by the customer.

RAPID ACCESS PRINTER

TENTATIVE SCHEDULE

PAR 203-A
10 Apr 64

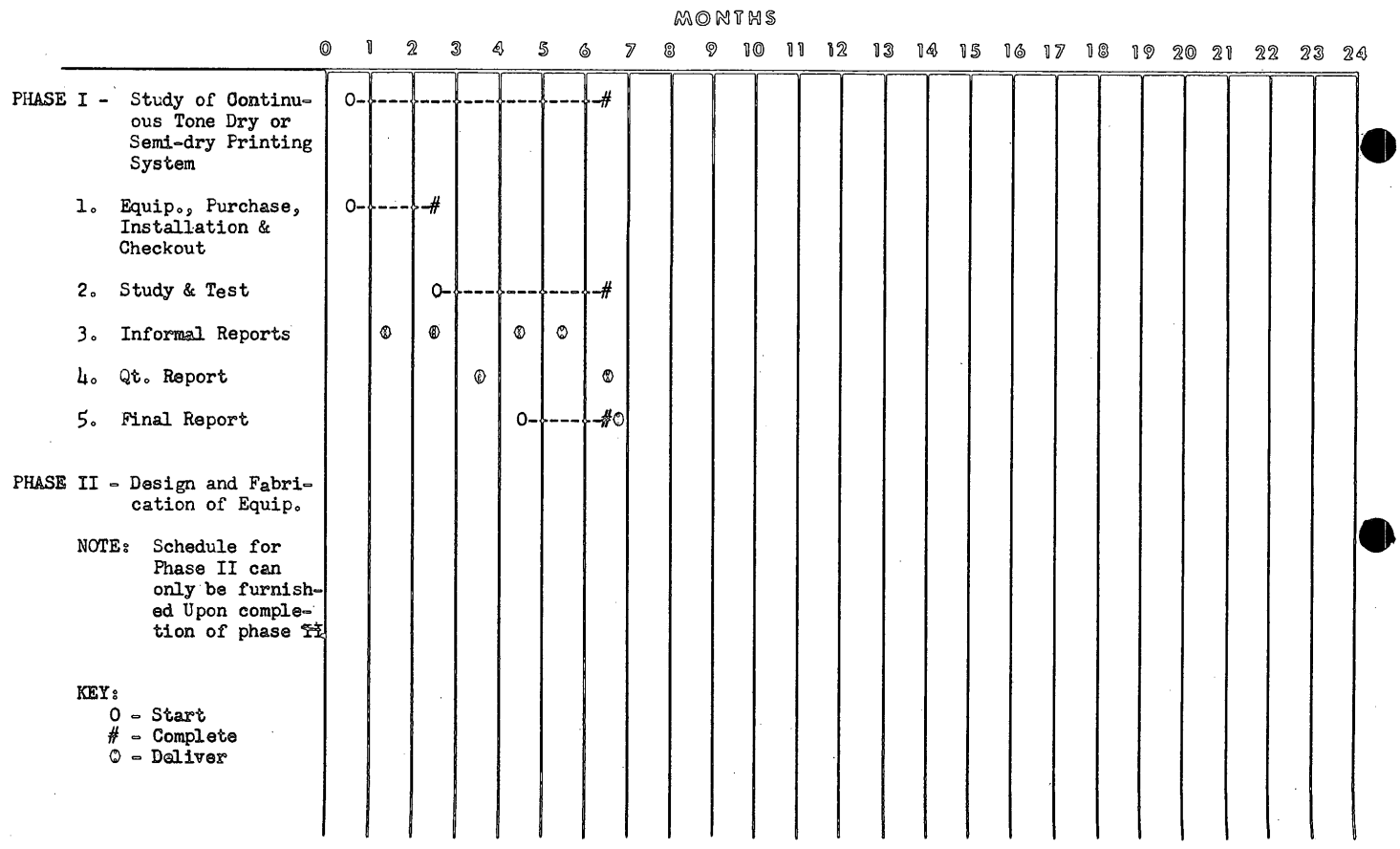


Fig. 1

Spec No. 203-A

Date 29 Feb 64

SPECIFICATION
FOR
ROLLER TRANSPORT PROCESSOR (12 INCH)

TASK/PROBLEM

Design and fabricate a versatile, self-threading photographic processor capable of processing both sheets and continuous strips of film to either standard negative or reversal images. Changes from one process to the other accomplished with a minimum of operator effort.

PROCESSING METHOD

Roller transport conveyance through deep tanks. Agitation accomplished by action of the conveying rollers.

MATERIAL CAPABILITIES

Film Size
Cut Sheet - Minimum - 4 x 5 inches
Maximum - 11 x 14 inches

Note: Cut sheet films must be packaged and shipped in cut sheet form, not cut from roll stock.

Continuous Strip
Minimum - 16mm
Maximum - 9½" x 1000 feet

Material
Certain types of black-and-white aerial and commercial films.

Note: It should be recognized that with roller transport equipment, some of the thinner base materials may require a pilot tab at the leading edge in order to be self-threading.

Output Rates (Approximate)
Print Material - Negative - 15 ft/min
- Reversal - 10 ft/min

Original Material - Negative - 8 ft/min
Reversal - 5 ft/min

Spec No. 203-A

Date 29 Feb 64

SERVICE REQUIREMENTS (continued)

Water - Hot (150°F) and cold (60°F) Max.) service to operating area at 45 psi minimum.

Total consumption 6 to 8 gallons per minute controlled to ±½°F. Mixing and control equipment provided with processor.

Air - 25 psi instrument air.

Sewer - 4-inch Duriron service line.

Spec No. 203-A

Date 29 Feb 64

PROCESS TIME

Dry to Dry - Negative - 5 min
Reversal - 7 min

Original Material - Negative - 9 min
Reversal - 14 min

PRODUCT QUALITY

Negative - Archival (indefinite keeping)
Reversal - Good commercial quality (approximately 5 years)

PROCESS TEMPERATURE

70°F to 110°F

REVERSAL CAPABILITY

Equipment to be capable of reversal image exposure by both chemical fogging and/or white light flashing.

OPERATION

Processor to be capable of daylight operation for all continuous strip materials up to the capacity of the USAF, A-9 Film Magazine.

Feed of all cut sheet materials into the processor will be accomplished under normal dark room operation.

PHYSICAL DIMENSIONS

Overall Dimensions (approximate)

Length - 13 feet, 6 inches
Width - 40 inches
Height - 45 inches
Weight - 2,000 pounds

SERVICE REQUIREMENTS

Power - 120/208 volt, 3 phase, 4 wire 60 cycle a.c. can be converted to 230 volt, 3 phase, 3 wire or 230 volt single phase, 3 wire, 12 to 15 kilowatts.

DESIGN OBJECTIVE

Quick and Dirty Printout (PAR-203)

Problem

The task of the photo interpreter is well known to be mechanically tedious, visually demanding and mentally fatiguing. It is suggested that a thorough study of the photo interpretation task properly reflected in hardware design could reduce the mechanical and visual demands made upon the interpreter and contribute to the accuracy and quantity of his output.

Proposal

Design and fabricate an integral photo interpretation work center incorporating features of convenience designed to lessen the tedium and improve the performance and communication of the photo interpreter.

The following items are design considerations:

1. Incorporate a convenient bidirectional motor driven film drive, continuously variable in speed, capable of rapid controlled stops and locking mechanism to maintain film position when stationary.

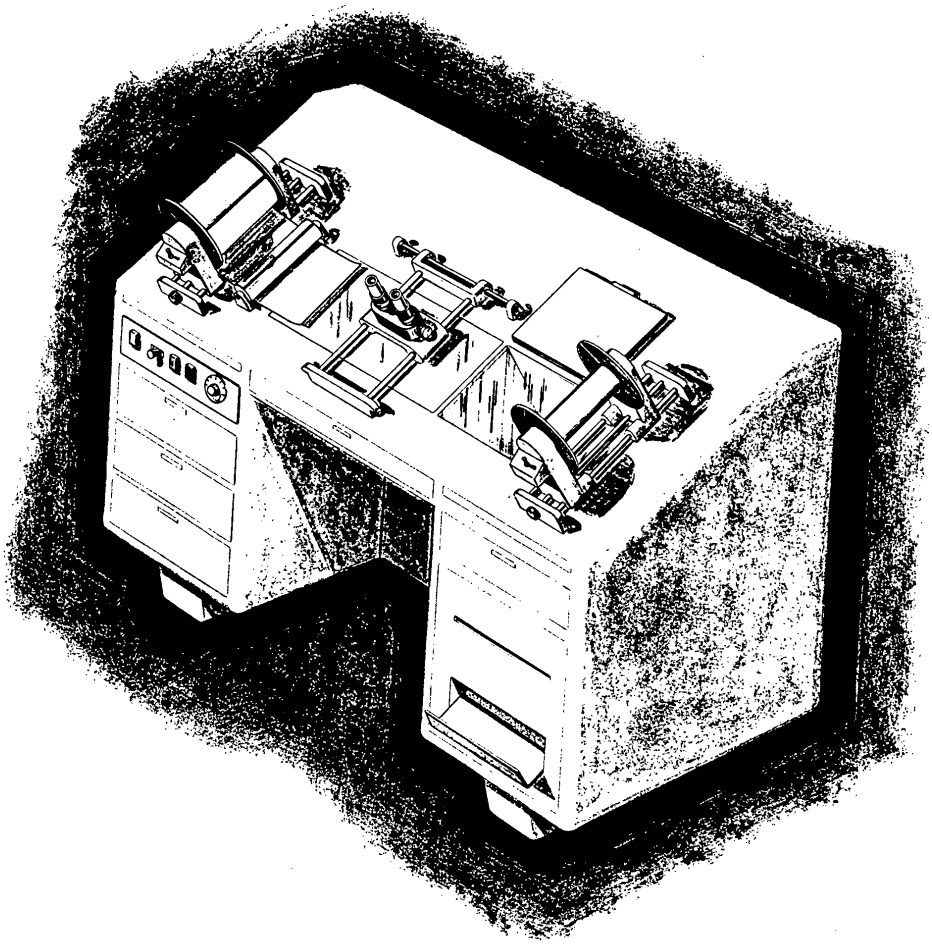
2. Incorporate a viewing surface evenly illuminated and capable of masking and brightness control. Viewing surface to be positioned for maximum comfort of seated operation.

3. Incorporate a microscope with convenient XY travel, selected magnification, and exit pupil and eye relief specifically selected for operator comfort and convenience.

4. Incorporate a means for making "quick and dirty" prints so that the operator can communicate readily concerning areas of interest. Print making and processing to be accomplished without leaving the work center.

5. Provide convenient storage for Photo Interpreters routine type equipment. Provide convenient work surfaces for note taking, auxiliary records, etc.

6. Incorporate human engineering study to determine arrangement of above items for maximum efficiency, comfort and convenience of the operator.



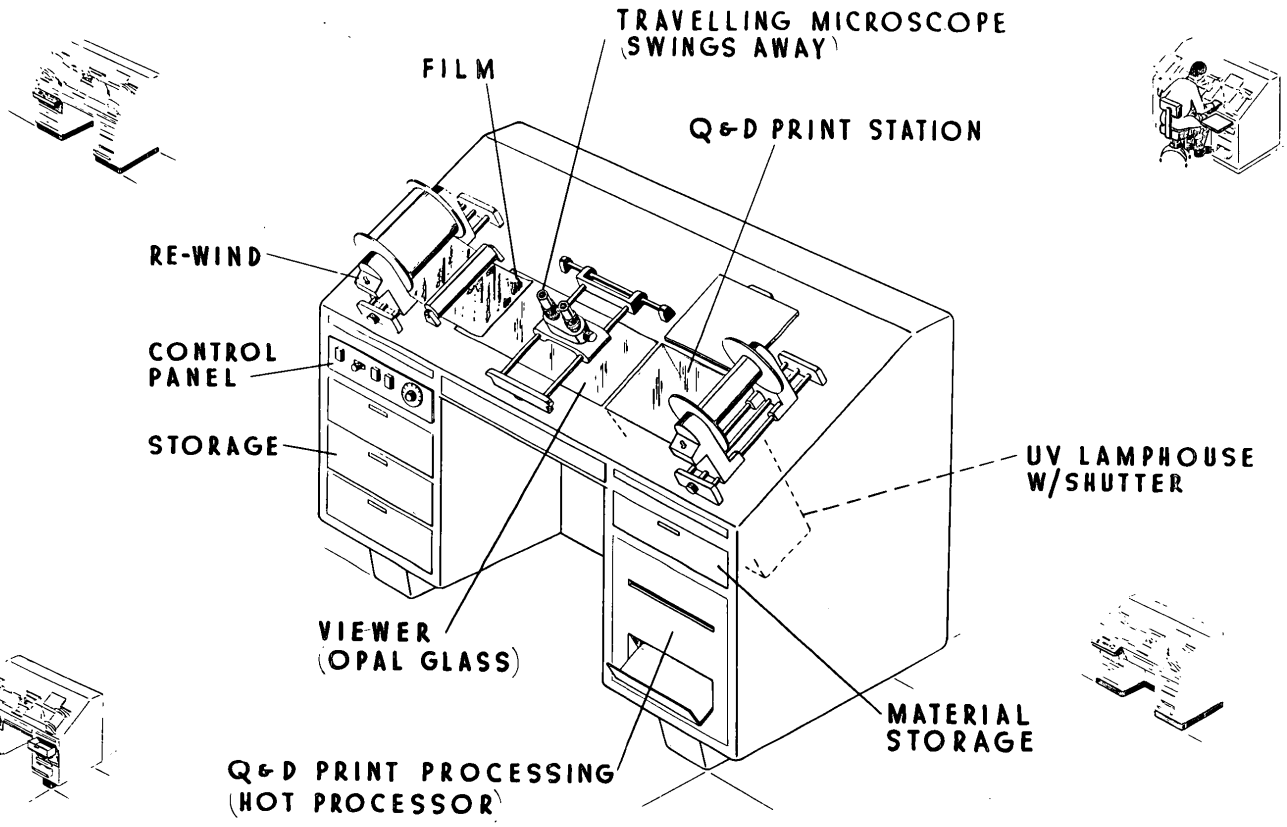
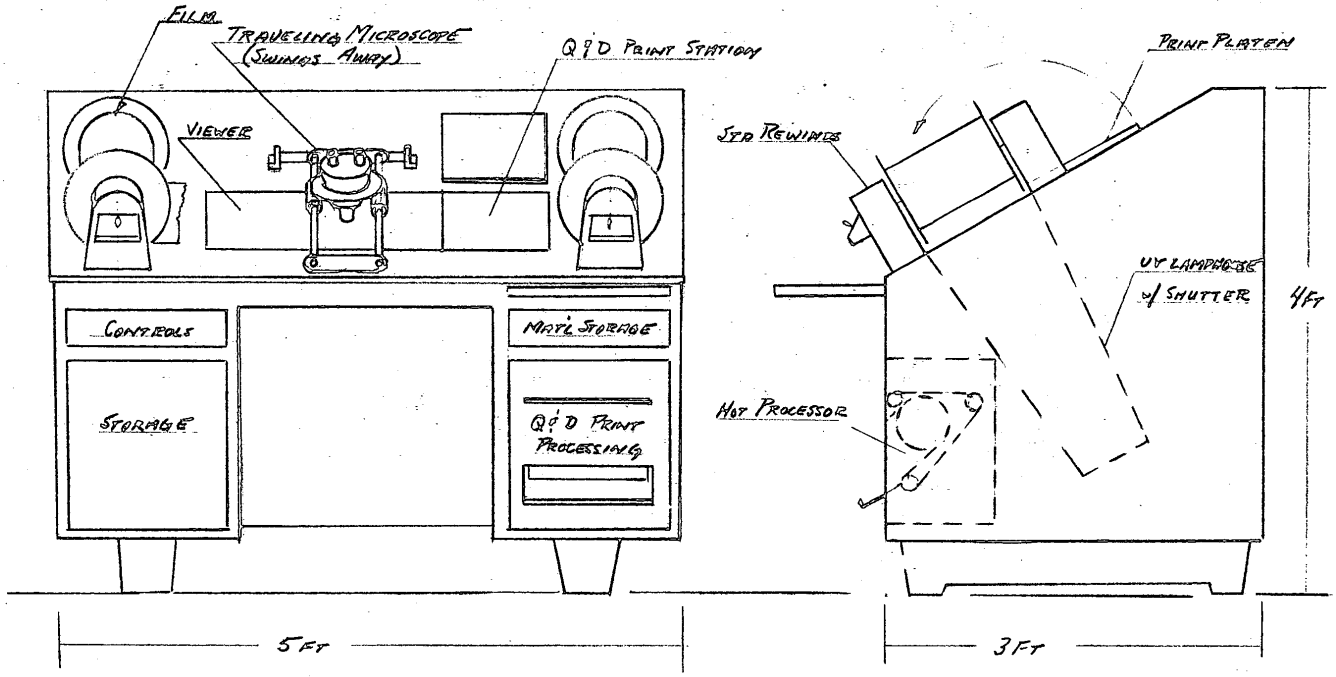


PHOTO INTERPRETATION WORK CENTER

P.I. TABLE



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